United States
Department of
Agriculture

Soil
Conservation
Service

Spokane,
Washington

Washington Water Supply Outlook

JUNE 1, 1987

Foreword

How Forecasts Are Made

Most of the annual streamflow in the Western United States originates as snowfall. This snowfall accumulates high in the mountains during winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Predictions are based on careful measurements of snow water equivalent at selected index points. Precipitation, temperature, soil moisture and antecedent streamflow data are viewed in conjunction with snowpack data to prepare runoff forecasts. This report presents a comprehensive picture of water supply outlook conditions for areas dependent upon surface runoff. It includes selected streamflow forecasts, summarized snowpack and precipitation data, reservoir storage data and narratives describing current conditions.

Streamflow forecasts are cooperatively generated by Soil Conservation Service and National Weather Service hydrologists. Forecasts become more accurate as more data affecting runoff becomes known. For this reason, forecasts are issued that reflect three future precipitation conditions — Below Normal, Average, and Above Normal. These forecasts are termed reasonable minimum, most probable, and reasonable maximum. Actual streamflow can be expected to fall between the lower and upper forecast values eight out of ten years.

Snowpack data are obtained by using a combination of manual and automated measurement methods. Manual readings of snow depth and water equivalent are taken at locations called snow courses on a monthly or semi-monthly schedule during the winter. In addition, snow water equivalent, precipitation, temperature, and other parameters are monitored on a daily basis and transmitted via radio telemetry to central data collection facilities. Both monthly and daily data are used to project snowmelt runoff.

For More Information

Copies of Monthly Water Supply Outlook Reports and other reports may be obtained from the states listed below. Because of the limited space, snow survey measurements are not published in monthly reports. An annual snow survey data summary is published by the Soil Conservation Service for each of the western states. Historical snow survey data may be obtained at those same offices.

STATE	ADDRESS
Alaska	201 East 9th Ave., Suite 300, Anchorage, AK 99501-3687
Arizona	201 East Indianola, Suite 200, Phoenix, AZ 85012
Colorado	2490 West 26th Ave., Denver, CO 80211
New Mexico	517 Gold Ave. S.W., Room 3301, Albuquerque, NM 97102
Idaho	304 North 8th Street, Room 345, Boise, ID 83702
Montana	10 East Babcock, Room 443, Federal Building, Bozeman, MT 59715
Nevada	1201 Terminal Way, Room 219, Reno, NV 89502
Oregon	1220 Southwest 3rd Ave., Room 1640, Portland, OR 97208
Utah	4402 Federal Building, 125 South State Street, Salt Lake City, UT 84147
Washington	360 U.S. Court House, Spokane, WA 99201
Wyoming	Federal Building, 100 East "B" Street, Casper, WY 82601

In addition to state reports, a Water Supply Outlook for the Western United States is published by the Soil Conservation Service and National Weather Service monthly, January through May. Reports may be obtained from the Soil Conservation Service, West National Technical Center, 511 Northwest Broadway, Room 547, Portland, OR 97209.

Published by other agencies:

Water Supply Outlook Reports prepared by other agencies include: California — Snow Survey Branch, California Department of Water Resources, P.O. Box 388, Sacramento, CA 95802; British Columbia — The Ministry of Environment, Water Investigations Branch, Parliament Buildings, Victoria, British Columbia, V8V 1X5; Yukon Territory — Department of Indian and Northern Affairs, Northern Operations Branch, 200 Range Road, Whitehorse, Yukon Territory, Y1A 3V1; Alberta, Environment Technical Services Division, 9820 106th St., Edmonton, Alberta T5K 2J6.

Washington Water Supply Outlook

and

Federal — State — Private Cooperative Snow Surveys

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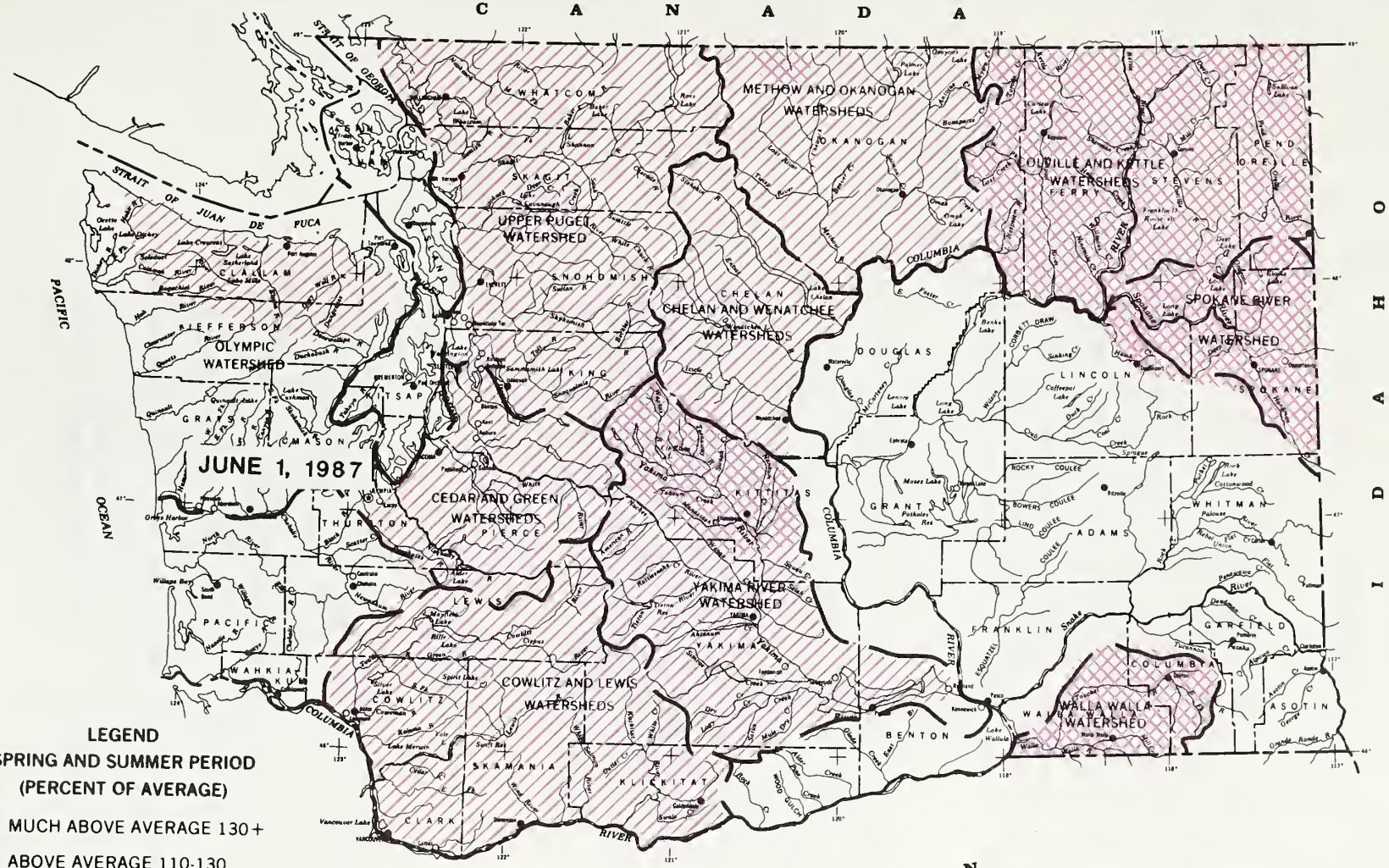
U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



JUNE 1, 1987

LEGEND
SPRING AND SUMMER PERIOD
(PERCENT OF AVERAGE)

- MUCH ABOVE AVERAGE 130+
- ABOVE AVERAGE 110-130
- NEAR AVERAGE 90-110
- BELOW AVERAGE 70-90
- MUCH BELOW AVERAGE 70+ LESS
- NOT FORECAST
- WATERSHED BOUNDARY

N

0 25 50 75 100 MI

0 50 100 150 KM

JUNE 1, 1987

STREAMFLOW PROSPECTS
WASHINGTON

SOURCE: Data compiled by SCS Field Personnel.

JANUARY 1986 4-R-39641

BASE 4-R-39260

GENERAL OUTLOOK

SUMMARY:

June water supply forecasts indicate below normal runoff for 1987 in Washington. 1987 will go down as a poor water year for northwestern states. The snowpack, except in isolated areas, is gone. Peak stream runoff has occurred. Reservoir storage remains below normal at the major irrigation projects throughout the state. Snow cover and precipitation continue to be below average. May streamflows were below average in eastern and southern Washington. The terms "normal" and "average," as used in this publication, are the same.

SNOWPACK:

The snowpack remains in only the areas above 5500 feet. Eleven of 37 SNOTEL sites have snow remaining. All areas of Washington are below average with the Spokane Basin at 18% of normal, and the Colville-Pend Oreille River 23% of average. The eastern slopes of the Cascade Mountains have decreased from last month with the Wenatchee-Chelan Basin at 44%, down from 76% last month, and the Yakima Basin at 25%, down from 59%. On the western slopes of the Cascades, the Lewis and Cowlitz basins are at 22% and the Skagit 48% and Green at 21% of normal. State wide snow-cover is 27% of normal.

PRECIPITATION:

May precipitation values from SNOTEL sites indicate a water year value near 85% of average for the high mountain areas of Washington. National Weather Service data for Washington showed the Pend Oreille Basin with 81% of normal and the Spokane with 81%; both on the low side. Other values include the Yakima at 110% and the White-Green Basin with 131%. Precipitation in May was normal along the western slope of the Cascade Mountains and much below normal for the rest of Eastern Washington. A severe thunderstorm centered over the lower Methow River caused gully erosion to range and roadways. For added data on precipitation see pages 25 and 26 of this report.

RESERVOIRS:

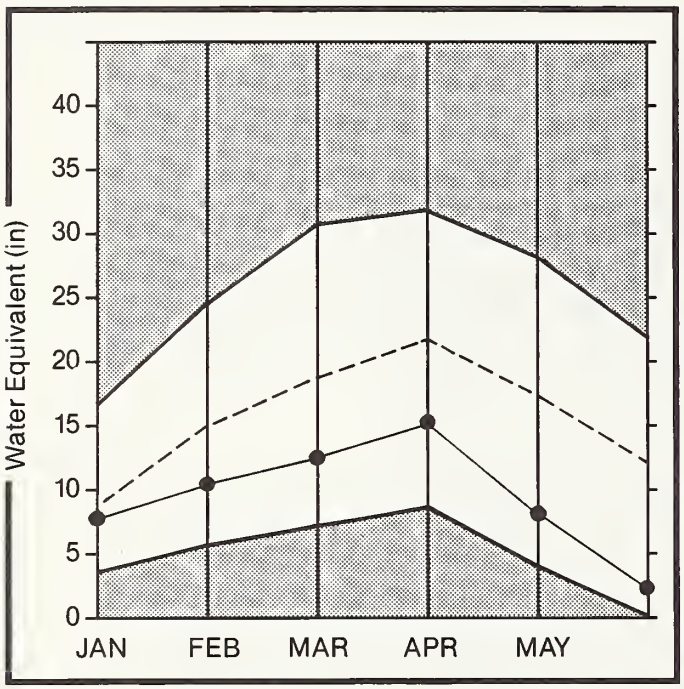
June 1 reservoir storage in the Yakima Basin was 878,800 acre feet, 94% of average, up from 93% last month. Other major irrigation reservoir storage remains good in Washington with Roosevelt at 146% of normal and being held high due to low summer runoff forecasts. Banks Lake is at 169% and the Okanogan reservoirs at 106% of June 1 average. The power reservoirs contain the following: Coeur d' Alene Lake 280,200 acre feet or 96% of capacity, Chelan Lake 516,800 acre feet at 76% of capacity and Ross Lake at 1,187,700 acre feet or 85% of capacity.

STREAMFLOW:

June streamflow forecasts vary from 51% in the Spokane River to 80% in the Skagit River. May streamflows were below normal in most areas of Washington. Streamflow varied from 27% on the Walla Walla River and the maximum of 140% from the Chelan River. On the west side of the Cascade Mountains, runoff from the Chehalis was 57%, the Skagit 114% and the Skykomish 101% of normal. The eastern slope of the Cascades runoff on the Yakima was 78%, Wenatchee at 124%, and the Okanogan at 116% of average. The Columbia River was 106% at the International Border. In Eastern Washington, the Spokane streamflow was 46% of normal and the Pend Oreille 76%.

SPOKANE

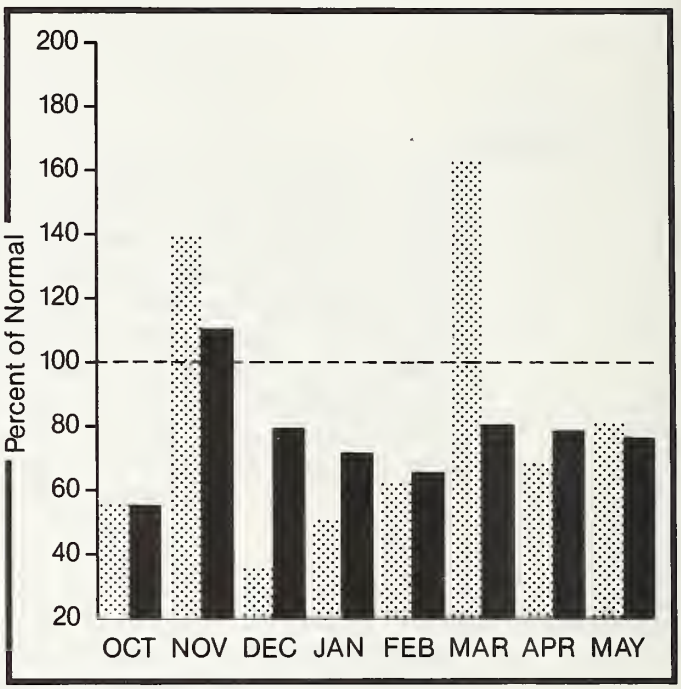
Mountain snowpack* (inches)



*Based on selected stations

Maximum
Minimum
Average
Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation
Year to date precipitation

SPOKANE RIVER BASIN

WATER SUPPLY OUTLOOK:

Precipitation for May was 81% of normal. May streamflow on the Spokane River was 46% of average at Spokane. Forecasted summer runoff is 51% of normal. This forecast is based upon a snowpack that is 18% of average and a water year to date precipitation value of 79% of normal. Storage in Coeur d' Alene Lake was 280,200 acre feet compared to 215,000 last year; average storage in Cd'A for June 1 is 317,200 acre feet. Maximum snow water occurred at the Bear Mtn. SNOTEL with 13 inches of water content.

For more information contact your local Soil Conservation Service office.

SPOKANE RIVER BASIN

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
SPOKANE at Post Falls	MAY-SEP	1956.0	990.0	51	1420.0	73	560.0	29
	MAY-JUL	1858.0	950.0	51	1359.0	73	541.0	29
SPOKANE at Long Lake	MAY-JUL	2097.0	1070.0	51	1531.0	73	609.0	29

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.
COEUR D'ALENE	291.2	280.2	219.8	353.9

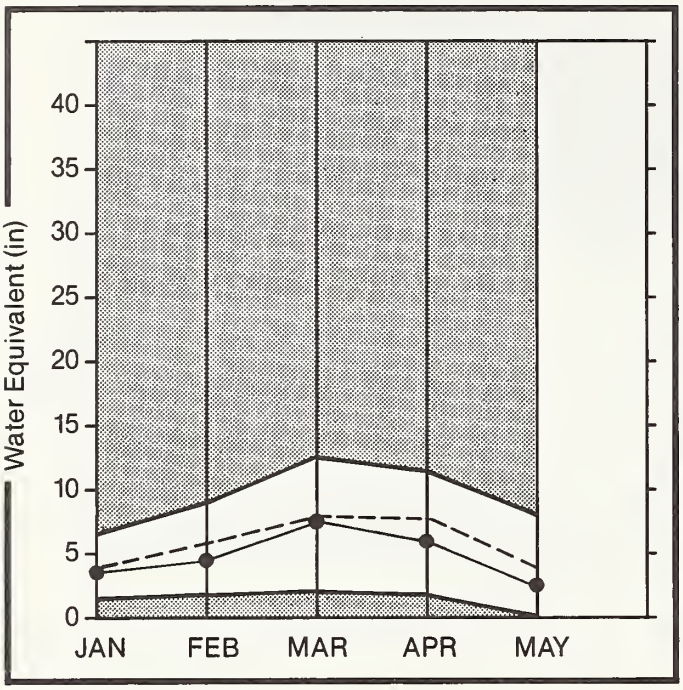
WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	AVERAGE
Spokane River	4	18	8

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

COLVILLE AND PEND OREILLE

Mountain snowpack* (inches)



*Based on selected stations

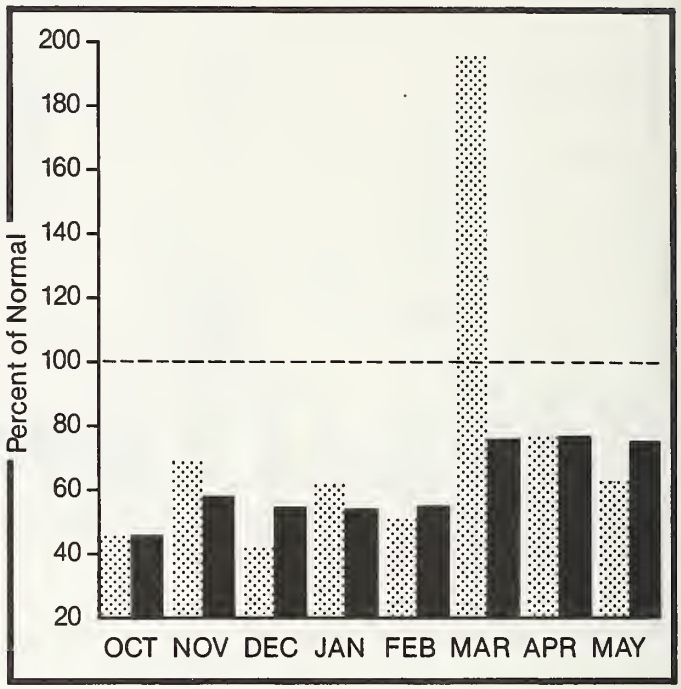
Maximum

Minimum

Average

Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation

Year to date precipitation

COLVILLE - PEND OREILLE RIVER BASINS

WATER SUPPLY OUTLOOK:

Streamflows for the Pend Oreille River are forecasted to be 56% of normal for rest of the summer. Other forecasts are the Kettle River 60%, and the Colville River 58% of normal for the summer runoff period. Snow cover basin-wide is 23% of average. Maximum snowpack measurement for the basin was at Schweitzer Basin with 8.3 inches of water. Precipitation during May was 62% of average, bringing the water year to date to 73% of normal. Streamflows for May were 76% of average on the Pend Oreille River, 74% on the Kettle River and 106% on the Columbia River at the International Border.

For more information contact your local Soil Conservation Service office.

COLVILLE - PEND OREILLE RIVER BASINS

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
PEND OREILLE RIVER bl Box Canyon 2	MAY-SEP	13100.0	7340.0	56	9960.0	76	4720.0	36
	MAY-JUL	11840.0	6630.0	56	9000.0	76	4260.0	36
	MAY-JUN	9879.0	5530.0	56	7500.0	76	3550.0	36
CHAMOKANE CREEK	MAY-AUG	9.2	5.2	57	9.0	98	2.0	22
	JUL-AUG	3.6	1.9	53	3.0	83	1.0	28
COLVILLE RIVER at Kettle Falls	MAY-SEP	89.0	51.0	57	84.0	94	18.0	20
	MAY-JUL	78.0	45.0	58	74.0	95	16.0	21
	MAY-JUN	68.0	39.0	57	64.0	94	14.0	21
KETTLE RIVER nr Laurier	MAY-SEP	1644.0	1000.0	61	1300.0	79	700.0	43
	MAY-JUL	1545.0	940.0	61	1220.0	79	660.0	43
	MAY-JUN	1362.0	820.0	60	1070.0	79	570.0	42
COLUMBIA RIVER at Birchbank 2	MAY-SEP	41540.0	35000.0	84	42100.0	101	28000.0	67
	MAY-JUL	32600.0	27000.0	83	32500.0	100	21500.0	66
	MAY-JUN	22800.0	19000.0	83	22900.0	100	15100.0	66
COLUMBIA RIVER at Grand Coulee 2	MAY-SEP	59780.0	45400.0	76	51400.0	86	39400.0	66
	MAY-JUL	49060.0	36800.0	75	41700.0	85	31900.0	65
	MAY-JUN	36760.0	27600.0	75	31300.0	85	24000.0	65

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.
ROOSEVELT	5232.0	4212.7	2990.6	2851.0
BANKS	715.0	706.9	688.2	418.0

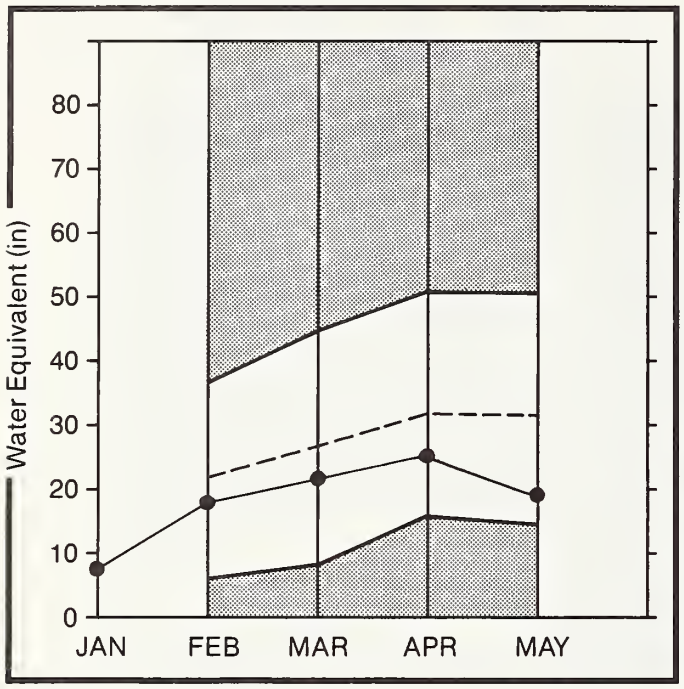
WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	THIS YEAR AS % OF AVERAGE
Colville River	0	0	0
Pend Oreille River	6	43	14
Kettle River	1	0	0

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

OKANOGAN AND METHOW

Mountain snowpack* (inches)



*Based on selected stations

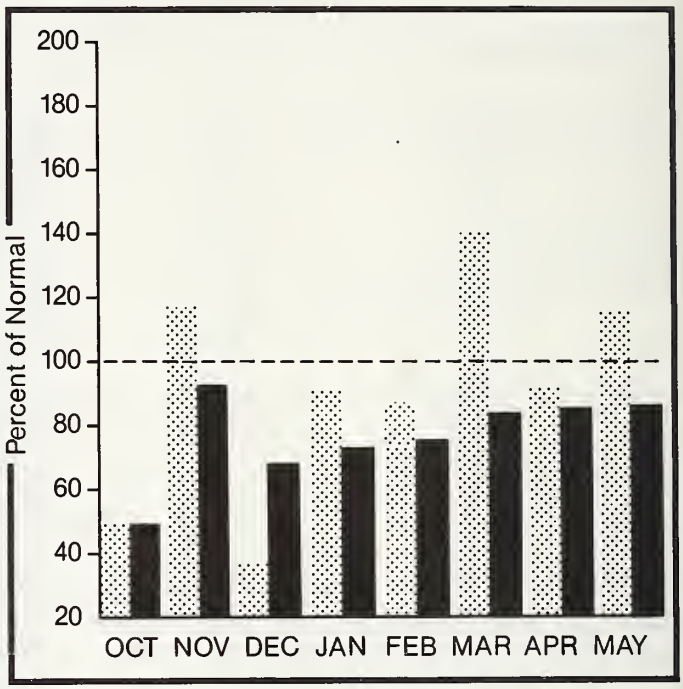
Maximum

Minimum

Average

Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation

Year to date precipitation

OKANOGAN - METHOW RIVER BASINS

WATER SUPPLY OUTLOOK:

Summer runoff forecasted for the Okanogan River is 72% of normal. The Similkameen River 67% and the Methow River is 73% of normal. Okanogan River streamflow was at 116% of average for May, while on the Similkameen River it was 124%. Snow cover as of June 1 is 23% of average on the Okanogan-Methow Basin, down from 59% last month. Maximum snow water occurred at Harts Pass SNOTEL, elevation 6000 feet, with 12.4 inches of water, down from 81 inches of snow and 36 inches of water content on May 1. May precipitation in the Okanogan was at 117% with water year to date 85% of average. Storage in the Conconully Reservoirs is at 19,100 acre feet which is 81% of capacity and 106% of June 1 average.

For more information contact your local Soil Conservation Service office.

OKANOGAN - METHOW RIVER BASINS

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
SIMILKAMEEN R. nr Nighthawk	MAY-SEP	1345.0	900.0	67	1170.0	87	630.0	47
	MAY-JUL	1246.0	830.0	67	1080.0	87	580.0	47
	MAY-JUN	1042.0	700.0	67	900.0	86	490.0	47
OKANOGAN R. nr Tonasket	MAY-SEP	1527.0	1100.0	72	1340.0	88	860.0	56
	MAY-JUL	1367.0	970.0	71	1190.0	87	750.0	55
	MAY-JUN	1123.0	800.0	71	980.0	87	620.0	55
METHOW RIVER nr Pateros	MAY-SEP	898.0	660.0	73	880.0	98	440.0	49
	MAY-JUL	824.0	610.0	74	810.0	98	410.0	50
	MAY-JUN	687.0	510.0	74	680.0	99	350.0	51

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.
CONCONULLY LAKE (SALMON)	10.5	10.3	9.2	9.0
CONCONULLY RESERVOIR	13.0	8.8	9.3	9.0

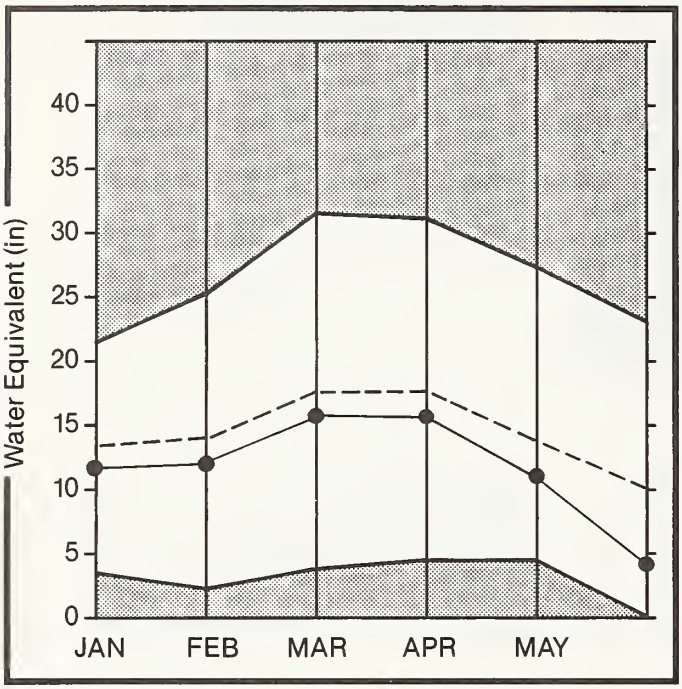
WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	THIS YEAR AS % OF AVERAGE
Okanogan River	11	39	34
Methow River	1	44	33

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

WENATCHEE AND CHELAN

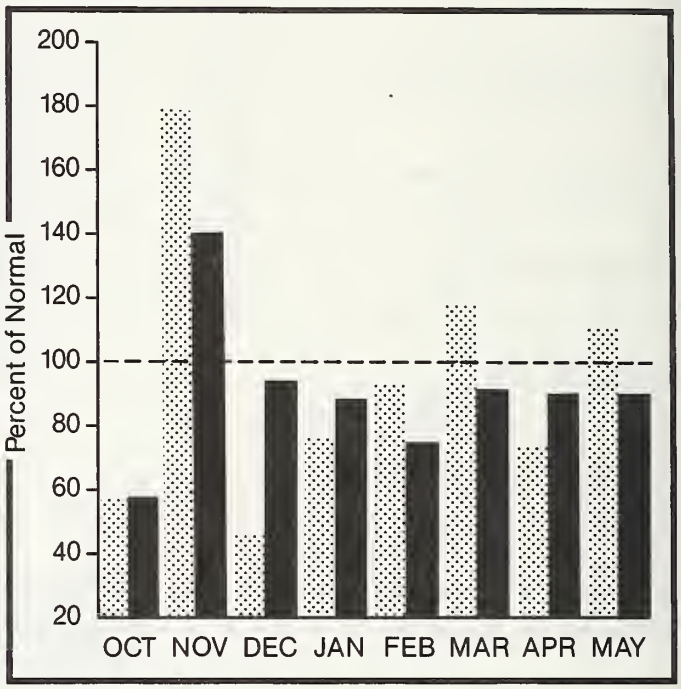
Mountain snowpack* (inches)



*Based on selected stations

Maximum
Minimum
Average
Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation
Year to date precipitation

WENATCHEE - CHELAN RIVER BASINS

WATER SUPPLY OUTLOOK:

Runoff for the Wenatchee River is forecast to be 73% of normal, down from 75% last month. Forecasts in the Chelan and Stehekin River runoff are for 73% of average. Stemilt and Icicle are forecast at 71% and 77%. May streamflow within the basin was 124% of normal on the Wenatchee and 140% on the Chelan River. May precipitation was 110% of normal in the basin and 90% for the water year to date. Reservoir storage in Lake Chelan is at 516,800 acre feet or 114% of June 1 average and 76% of capacity. Snowpack in the Wenatchee-Chelan Basin is 44% of normal, down from 76% last month. Lyman Lake had the most snow water with 30.1 inches on June 1, down from 55.6 inches on May 1.

For more information contact your local Soil Conservation Service office.

WENATCHEE - CHELAN RIVER BASINS

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
CHELAN RIVER at Chelan 1	MAY-SEP	1075.0	785.0	73	950.0	88	620.0	58
	MAY-JUL	931.0	690.0	74	830.0	89	550.0	59
	MAY-JUN	707.0	520.0	74	630.0	89	410.0	58
STEHEKIN R. at Stehekin	MAY-SEP	775.0	570.0	74	650.0	84	490.0	63
	MAY-JUL	645.0	480.0	74	550.0	85	420.0	65
	MAY-JUN	473.0	350.0	74	400.0	85	300.0	63
ENTIAT RIVER nr Ardenvoir	MAY-SEP	217.0	160.0	74	190.0	88	130.0	60
	MAY-JUL	195.0	145.0	74	175.0	90	115.0	59
	MAY-JUN	155.0	115.0	74	140.0	90	90.0	58
WENATCHEE RIVER at Plain	MAY-SEP	1136.0	850.0	75	1230.0	108	480.0	42
	MAY-JUL	1002.0	750.0	75	1080.0	108	420.0	42
	MAY-JUN	765.0	570.0	75	820.0	107	320.0	42
WENATCHEE R. at Peshastin	MAY-SEP	1489.0	1100.0	74	1590.0	107	610.0	41
	MAY-JUL	1327.0	980.0	74	1420.0	107	540.0	41
	MAY-JUN	1027.0	760.0	74	1100.0	107	420.0	41
STEMILT nr Wenatchee (miners in)	MAY-SEP	138.0	99.0	72	145.0	105	53.0	38
ICICLE CREEK nr Leavenworth	APR-SEP	370.0	290.0	78	410.0	111	170.0	46
	APR-JUL	340.0	265.0	78	380.0	112	150.0	44
	APR-JUN	270.0	210.0	78	300.0	111	120.0	44
COLUMBIA R. bl Rock Island Dam 2	MAY-SEP	65060.0	49500.0	76	56700.0	87	42300.0	65
	MAY-JUL	53860.0	40400.0	75	46300.0	86	34500.0	64
	MAY-JUN	40550.0	30400.0	75	34900.0	86	25900.0	64

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.
CHELAN LAKE	676.1	520.4	599.0	450.6

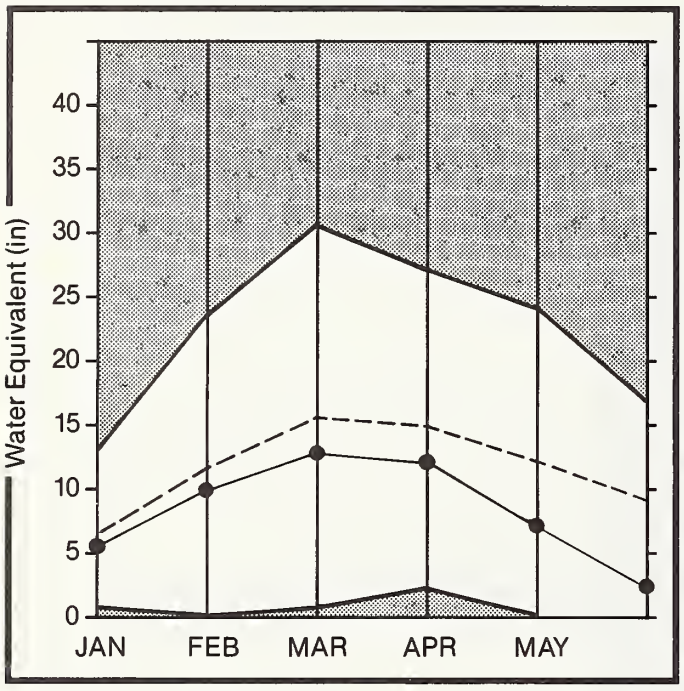
WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	AVERAGE
Chelan Lake Basin	4	81	57
Entiat River	0	0	0
Wenatchee River	3	80	40
Colockum Creek	0	0	0
Squilchuck Creek	0	0	0
Stemilt Creek	0	0	0

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

YAKIMA

Mountain snowpack* (inches)



*Based on selected stations

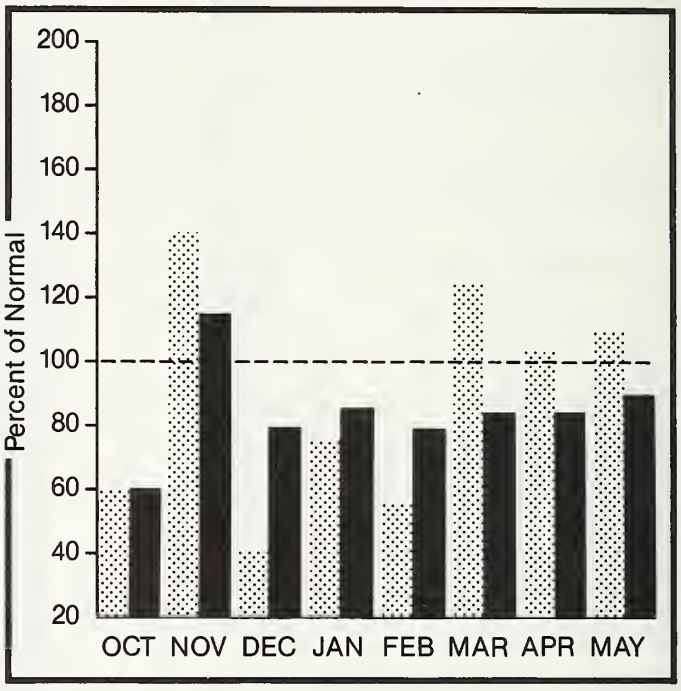
Maximum

Minimum

Average

Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation

Year to date precipitation

YAKIMA RIVER BASIN

WATER SUPPLY OUTLOOK:

June 1 reservoir storage for the five major reservoirs was at 878,800 acre feet or 94% of normal. Drafting of reservoir storage which started in April continued into May to meet the irrigation water demand. May streamflow for the Yakima Basin was 78% of normal. Forecasts for the Yakima Basin runoff vary throughout the basin as follows: the Yakima River at Cle Elum 63%, Naches River 72%, the Yakima River at Parker 70% and Ahtanum Creek 74%. Snowpack is 25% of average in the Yakima Basin based upon SNOTEL readings, last month it was 59% of normal. May precipitation was 110% of normal and 85% for the water year to date.

For more information contact your local Soil Conservation Service office.

YAKIMA RIVER BASIN

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
YAKIMA RIVER at Martin 1	MAY-SEP	109.0	69.0	63	82.0	75	56.0	51
	MAY-JUL	100.0	64.0	64	76.0	76	52.0	52
	MAY-JUN	85.0	54.0	64	64.0	75	44.0	52
YAKIMA RIVER at Cle Elum 2	MAY-SEP	786.0	510.0	65	610.0	78	400.0	51
	MAY-JUL	682.0	450.0	66	540.0	79	360.0	53
	MAY-JUN	570.0	380.0	67	450.0	79	300.0	53
YAKIMA RIVER nr Parker 2	MAY-SEP	1682.0	1180.0	70	1500.0	89	860.0	51
	MAY-JUL	1469.0	1040.0	71	1320.0	90	760.0	52
	MAY-JUN	1250.0	890.0	71	1130.0	90	350.0	28
KACHESS RIVER nr Easton 1	MAY-SEP	108.0	70.0	65	85.0	79	55.0	51
	MAY-JUL	89.0	58.0	65	70.0	79	46.0	52
	MAY-JUN	77.0	50.0	65	61.0	79	39.0	51
CLE ELUM RIVER nr Roslyn 1	MAY-SEP	393.0	260.0	66	300.0	76	210.0	53
	MAY-JUL	353.0	240.0	68	280.0	79	200.0	57
	MAY-JUN	289.0	200.0	69	240.0	83	170.0	59
BUMPING RIVER nr Nile 1	MAY-SEP	123.0	86.0	70	104.0	85	68.0	55
	MAY-JUL	112.0	78.0	70	95.0	85	61.0	54
	MAY-JUN	90.0	63.0	70	77.0	86	50.0	56
AMERICAN RIVER nr Nile	MAY-SEP	107.0	75.0	70	88.0	82	62.0	58
	MAY-JUL	97.0	68.0	70	80.0	82	56.0	58
	MAY-JUN	79.0	58.0	73	67.0	85	49.0	62
TIETON RIVER at Tieton 1	MAY-SEP	213.0	160.0	75	190.0	89	130.0	61
	MAY-JUL	177.0	135.0	76	160.0	90	100.0	56
	MAY-JUN	136.0	100.0	74	120.0	88	80.0	59
NACHES RIVER nr Naches 2	MAY-SEP	726.0	525.0	72	630.0	87	420.0	58
	MAY-JUL	645.0	470.0	73	560.0	87	380.0	59
	MAY-JUN	533.0	390.0	73	470.0	88	320.0	60
AHTANUM CREEK nr Tampico 2	MAY-SEP	39.0	29.0	74	38.0	97	20.0	51
	MAY-JUL	35.0	26.0	74	34.0	97	18.0	51
	MAY-JUN	29.0	22.0	76	28.0	97	16.0	55

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.
KEECHELUS	157.8	133.5	125.1	144.0
KACHESS	239.0	163.2	213.9	218.0
CLE ELEM	436.9	363.2	384.5	378.0
BUMPING LAKE	33.7	33.2	34.5	27.0
RIMROCK	198.0	185.2	179.9	167.0

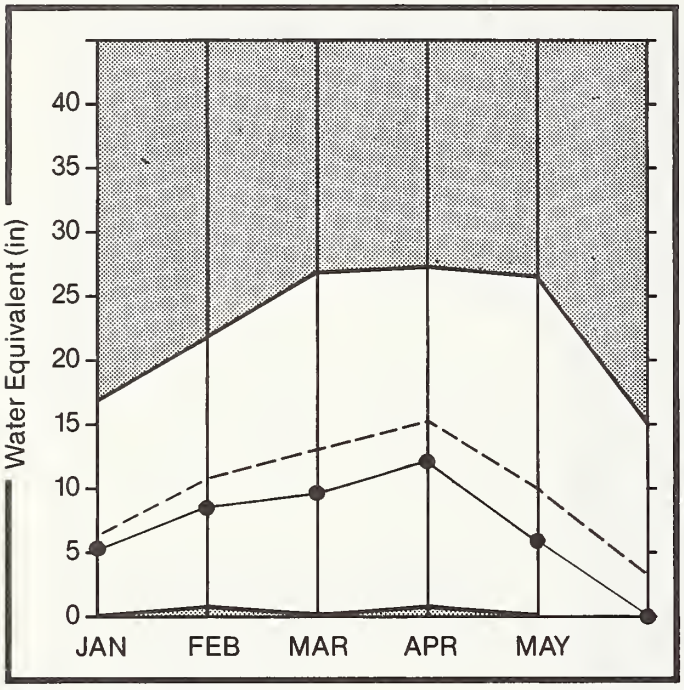
WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	THIS YEAR AS % OF AVERAGE
Yakima River	8	68	32
Ahtanum Creek	1	0	0

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

WALLA WALLA

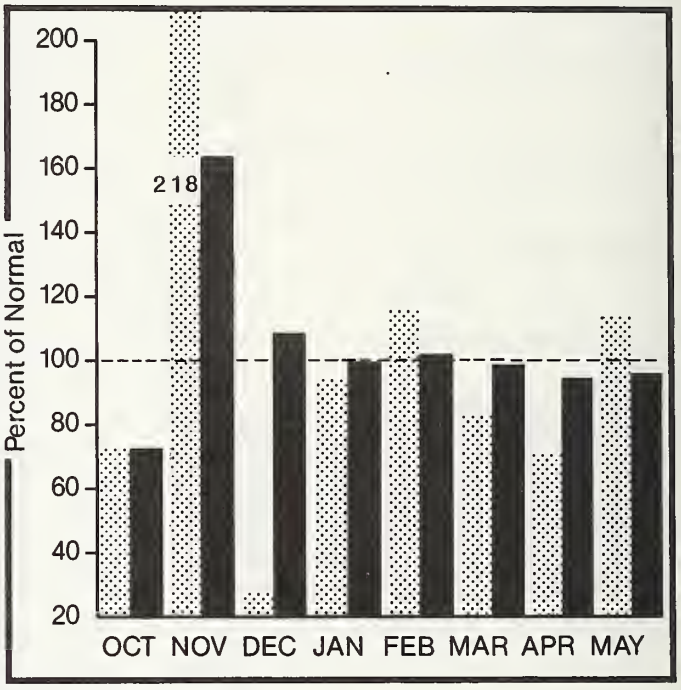
Mountain snowpack* (inches)



*Based on selected stations

Maximum
Minimum
Average
Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation
Year to date precipitation

WALLA WALLA RIVER BASIN

WATER SUPPLY OUTLOOK:

Forecasts are for 51% of average streamflow in the Walla Walla Basin for the coming summer. Streamflow for the Walla Walla River was at 27% of normal for May. May precipitation was 113% of average and the water year to date precipitation has been 94% of normal. Snowpack in the Walla Walla River Basin is gone. Water content at the Touchet SNOTEL site was gone by May 6.

For more information contact your local Soil Conservation Service office.

WALLA WALLA RIVER BASIN

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
MILL CREEK at Walla Walla	MAY-SEP	7.7	3.6	47	7.0	91	1.0	13
	MAY-JUL	7.5	3.4	45	6.0	80	1.0	13
	MAY-JUN	7.3	3.3	45	6.0	82	1.0	14
SF WALLA WALLA nr MiltonFreewater	MAY-JUL	39.0	19.5	50	28.0	72	12.0	31
COUSE CK nr Milton Freewater	MAY-JUL	1.6	0.7	44	1.0	62	0.0	0
PINE CREEK near Weston	MAY-JUL	0.8	0.3	38	1.0	125	0.0	0
COLUMBIA R. at The Dalles 2	MAY-SEP	88790.0	58200.0	66	69740.0	79	46660.0	53
	MAY-JUL	74070.0	47800.0	65	57430.0	78	38170.0	52
	MAY-JUN	57430.0	37330.0	65	44800.0	78	29860.0	52

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.

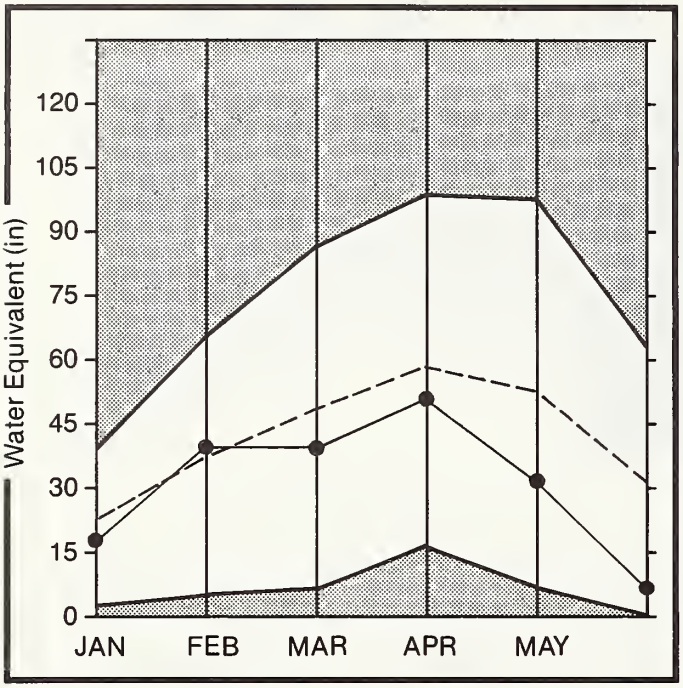
WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	AVERAGE
Mill Creek	1	0	0

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

COWLITZ AND LEWIS

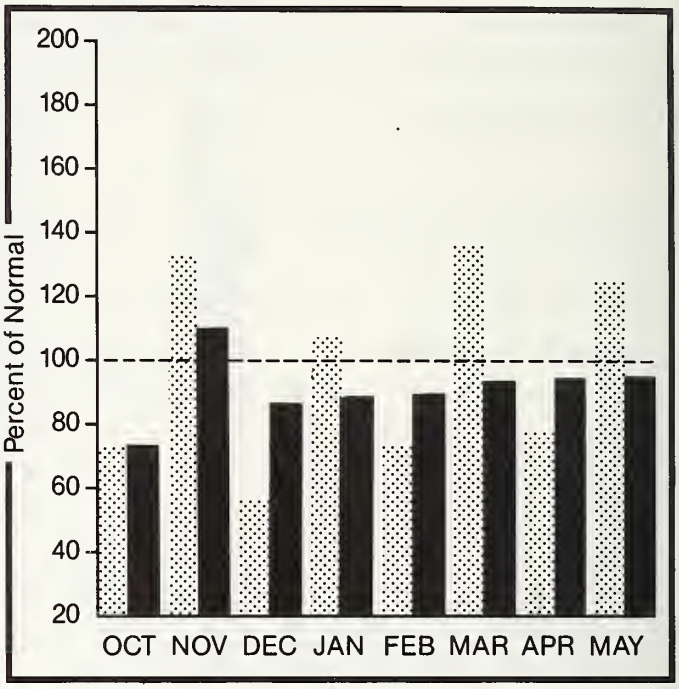
Mountain snowpack* (inches)



*Based on selected stations

Maximum
Minimum
Average
Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation
Year to date precipitation

COWLITZ - LEWIS RIVER BASINS

WATER SUPPLY OUTLOOK:

June forecasts for the Lewis River is 73% and for the Cowlitz River 70%. June 1 snow cover for the Cowlitz-Lewis Basin is at 22% of normal down from 59% for May 1. The Paradise SNOTEL site had the maximum water content for the basin with a snowpack containing 23.5 inches of water on May 31. May precipitation was 124% of normal bringing the water year to date precipitation to 95% of average. Climbing Mt. St Helens on a permit basis is now available from the US Forest Service.

For more information contact your local Soil Conservation Service office.

COWLITZ - LEWIS RIVER BASINS

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
LEWIS RIVER at Ariel 2	MAY-SEP	892.0	650.0	73	860.0	96	440.0	49
	MAY-JUL	732.0	530.0	72	700.0	96	350.0	48
	MAY-JUN	606.0	440.0	73	590.0	97	300.0	50
COWLITZ R. bl Mayfield Dam 2	MAY-SEP	1604.0	1120.0	70	1900.0	118	330.0	21
	MAY-JUL	1350.0	950.0	70	1610.0	119	290.0	21
	MAY-JUN	1092.0	760.0	70	1300.0	119	230.0	21
COWLITZ R. at Castle Rock 2	MAY-SEP	2050.0	1440.0	70	2450.0	120	440.0	21
	MAY-JUL	1706.0	1200.0	70	2040.0	120	360.0	21
	MAY-JUN	1378.0	970.0	70	1650.0	120	300.0	22

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.

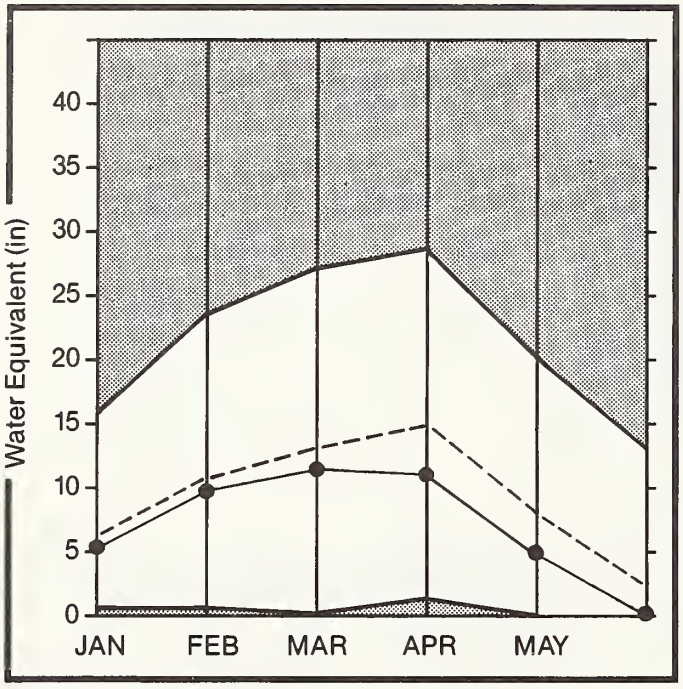
WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	AVERAGE
Cowlitz River	1	0	0
Lewis River	4	0	0

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

WHITE - GREEN

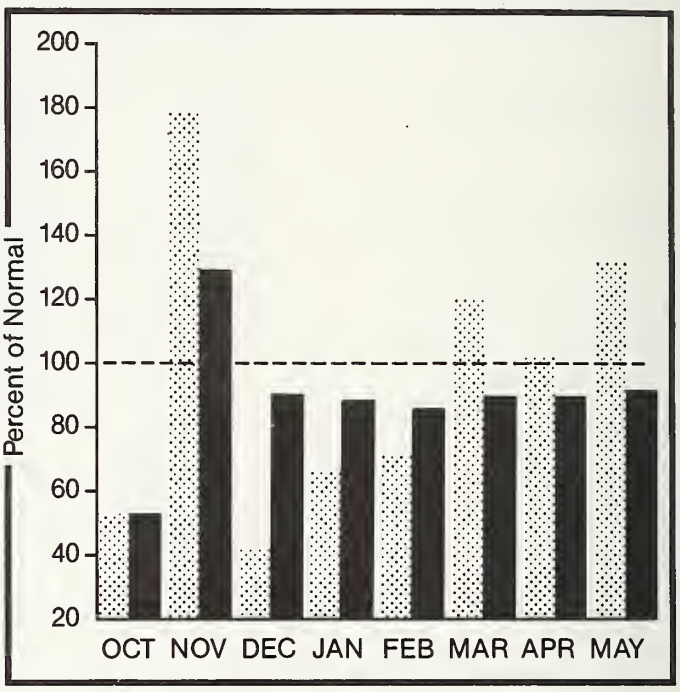
Mountain snowpack* (inches)



*Based on selected stations

Maximum
Minimum
Average
Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation
Year to date precipitation

WHITE - GREEN RIVER BASINS

WATER SUPPLY OUTLOOK:

May precipitation was 131% of normal, bringing the water year to date to 92% of average. Snowpack is 21% of normal for the basin, down from 64% last month. Summer runoff is forecasted to be 75% of normal on the Green and Cedar River's. Snow water content at the Corral Pass SNOTEL site was 12.8 inches on June 1.

For more information contact your local Soil Conservation Service office.

WHITE - GREEN RIVER BASINS

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
GREEN RIVER bl Howard Hanson Dam 2	MAY-SEP	207.0	157.0	76	190.0	92	120.0	58
	MAY-JUL	177.0	133.0	75	160.0	90	100.0	56
	MAY-JUN	153.0	118.0	77	140.0	92	92.0	60
CEDAR RIVER nr Cedar Falls	MAY-SEP	74.0	56.0	76	69.0	93	43.0	58
	MAY-JUL	65.5	50.0	76	61.0	93	39.0	60
	MAY-JUN	54.1	41.0	76	50.0	92	32.0	59

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.

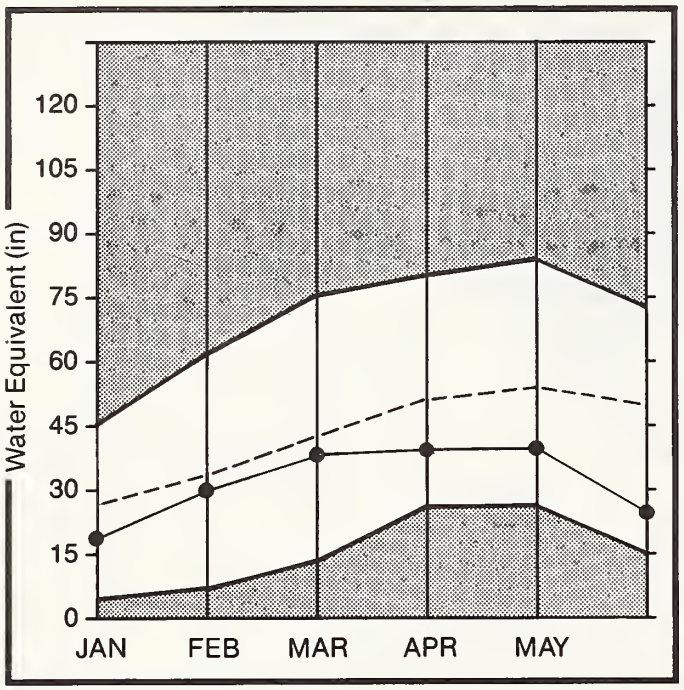
WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	AVERAGE
White River	2	78	58
Green River	2	0	0

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

NORTH PUGET SOUND

Mountain snowpack* (inches)



*Based on selected stations

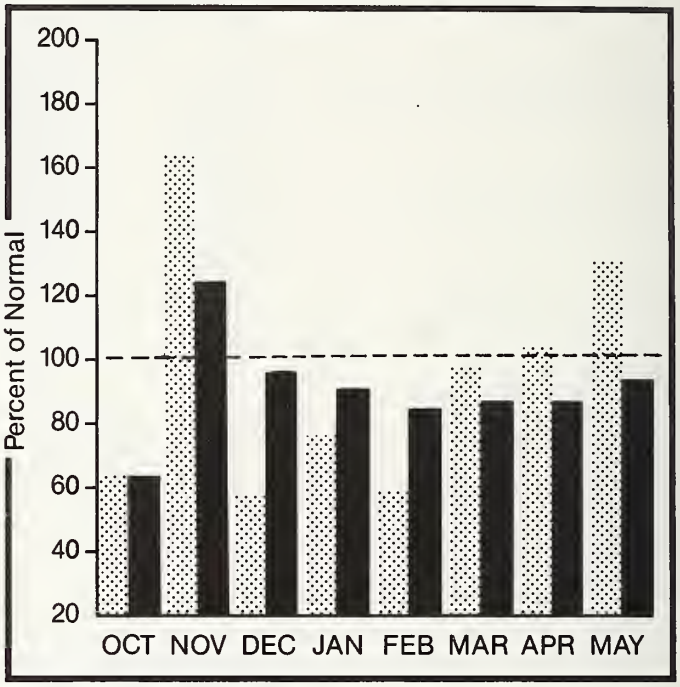
Maximum

Minimum

Average

Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation

Year to date precipitation

NORTH PUGET SOUND RIVER BASINS

WATER SUPPLY OUTLOOK:

Streamflow on the Skagit River during May was 114% of average. Runoff for the Skagit River is forecasted to be 80% of normal. Reservoir storage is above average with Ross Lake storing 1,187,700 acre feet as of June 1; 85% of capacity. Precipitation values for May were 131% of average with a water year to date at 92% of normal. Snow cover for June 1 in the North Puget Basin is 48% of normal with Harts Pass SNOTEL at 6500 feet in elevation having 12.4 inches of water content.

For more information contact your local Soil Conservation Service office.

NORTH PUGET SOUND RIVER BASINS

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
SKAGIT RIVER at Newhalem 2	MAY-AUG	2532.0	2050.0	81	2430.0	96	1670.0	66
	MAY-SEP	2062.0	1670.0	81	1980.0	96	1360.0	66
	MAY-JUL	1689.0	1360.0	81	1610.0	95	1110.0	66
	MAY-JUN	1485.0	1200.0	81	1420.0	96	980.0	66

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.
ROSS	1404.1	1187.7	1160.9	1033.9
DIABLO RESERVOIR	90.6	85.2	87.2	86.1
GORGE RESERVOIR	9.8	8.0	7.5	8.3

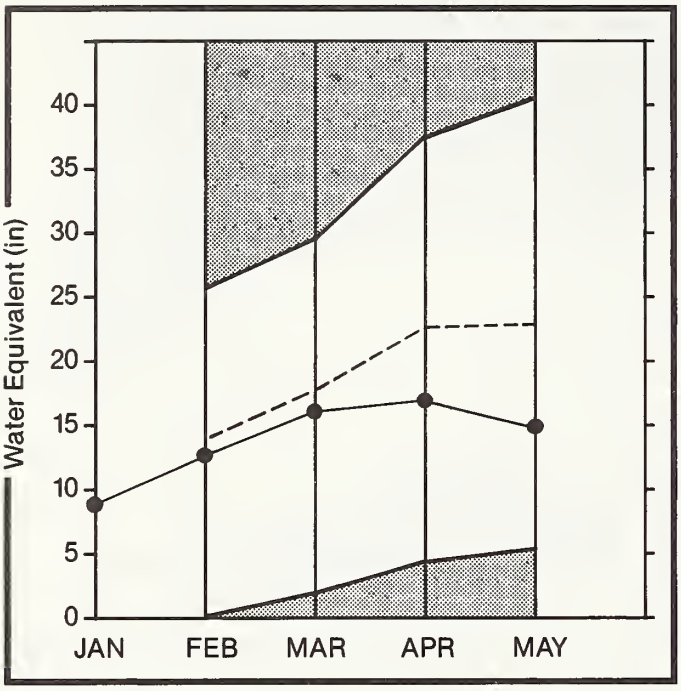
WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	THIS YEAR AS % OF AVERAGE
Skagit River	3	67	51
Baker River	0	0	0
Cedar River	0	0	0
Snoqualmie River	0	0	0
Skykomish River	1	0	0

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

OLYMPIC

Mountain snowpack* (inches)



*Based on selected stations

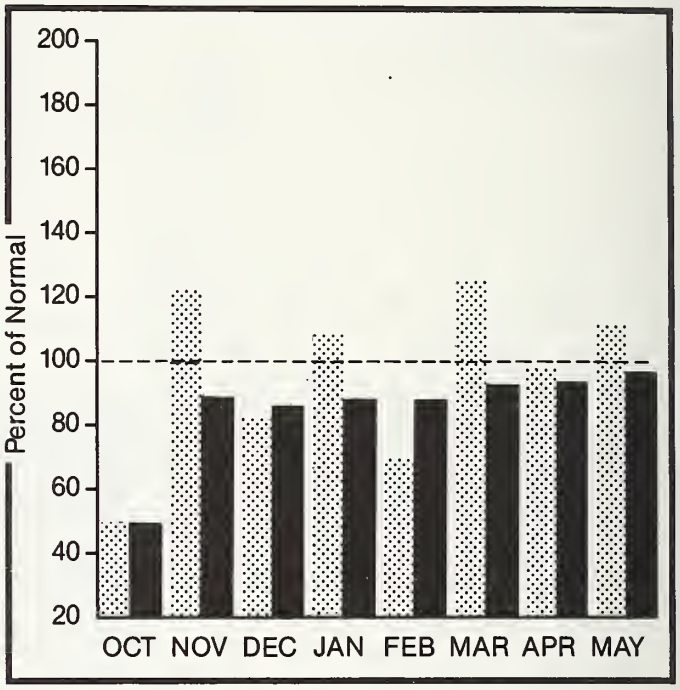
Maximum

Minimum

Average

Current

Precipitation* (percent of normal)



*Based on selected stations

Monthly precipitation

Year to date precipitation

OLYMPIC PENINSULA RIVER BASINS

WATER SUPPLY OUTLOOK:

The water year to date precipitation accumulation is 94% of normal. May precipitation was 110% of average. June 1 forecasts of runoff for streams in the basin are for 80% of average on the Dungeness River. Runoff forecast is 80% on the Elwah River. Snow cover is below normal, with no snow on the snow courses.

For more information contact your local Soil Conservation Service office.

OLYMPIC PENINSULA RIVER BASINS

STREAMFLOW FORECASTS

FORECAST POINT	FORECAST PERIOD	25 YR. AVG. (1000AF)	MOST PROBABLE (1000AF)	MOST PROBABLE (% AVG.)	REAS. MAX. (1000AF)	REAS. MAX. (% AVG.)	REAS. MIN. (1000AF)	REAS. MIN. (% AVG.)
DUNGENESS RIVER nr Sequim	MAY-SEP	137.0	110.0	80	130.0	95	90.0	66
	MAY-JUL	109.0	88.0	81	110.0	101	70.0	64
	MAY-JUN	97.0	79.0	81	95.0	98	65.0	67
ELWHA RIVER nr Port Angeles	MAY-SEP	451.0	360.0	80	440.0	98	280.0	62
	MAY-JUL	363.0	290.0	80	350.0	96	230.0	63

RESERVOIR STORAGE (1000AF)

RESERVOIR	USEABLE CAPACITY	** USEABLE STORAGE ** THIS YEAR	LAST YEAR	AVG.

WATERSHED SNOWPACK ANALYSIS

WATERSHED	NO. COURSES AVG'D	THIS YEAR AS % OF LAST YR.	AVERAGE
Dungeness River	0	0	0
Morse Creek	0	0	0
Elwha River	0	0	0

1 - Reas. max. and reas. min. forecasts are for 5% and 95% exceedance levels and also (2) below.
2 - Corrected for upstream diversions or changes in reservoir storage.
The average is computed for the 1961-85 base period.

United States Department of Agriculture | Soil Conservation Service | West National Technical Center Water Supply Forecasting Staff Portland, Oregon

S N O W - P R E C I P I T A T I O N U P D A T E

Based on Mountain Data from SCS SNOTEL Sites
As of SUNDAY: MAY 31 , 1987

BASIN Data Site Name	ELEV. (Ft)	SNOW WATER EQUIVALENT Current	Average	% of average	PRECIPITATION Year to date	% of average
WASHINGTON						
PRIEST, COEUR D'ALENE, ST. JOE, SPOKANE, PALOUSE, PEND OREILLE						
BEAR MOUNTAIN	5400	13.3	41.2	32	73.5	103
HUMBOLDT GULCH	4250	.0	.0	~	34.8	88
LOOKOUT	5140	.0	13.6	0	35.4	83
MOSQUITO RIDGE	5200	.0	17.5	0	43.5	88
QUARTZ PEAK	4700	- M	*	*	31.1	*
SCHWEITZER BASIN	6090	8.3	28.0	30	44.6	79
SHERWIN	3200	.1	.0	~	25.5	72
SQUAW FLAT	6240	.1	1.4	7	23.4	63
SUNSET	5540	.0	20.9	0	38.3	*
Basin wide percent of average				18		85
COLUMBIA ABOVE METHOW						
BUNCHGRASS MDW	5000	.1	15.7	1	36.5	*
HARTS PASS	6500	12.4	38.0	33	63.5	98
SALMON MEADOWS	4500	- M	.0	- M	- M	- M
Basin wide percent of average				23		98
CHELAN, ENTIAT, WENATCHEE						
BLEWETT PASS	4270	.0	.0	~	25.5	82
LYMAN LAKE	5900	30.1	49.6	61	78.7	103
MIRROR LAKE	5600	17.4	24.1	72	45.8	117
PARK CREEK RIDGE	4600	.0	12.8	0	56.6	92
POPE RIDGE	3540	.0	.0	~	28.1	92
RAINY PASS	4780	14.7	28.2	52	49.2	86
STEVENS PASS	4070	.3	28.5	1	69.6	83
TROUGH	5300	.1	.0	~	16.9	64
UPPER WHEELER	4400	.0	.0	~	20.4	79
Basin wide percent of average				44		90
YAKIMA, AHTANUM, WALLA WALLA, TOUCHET						
BUMPING RIDGE	4600	- M	1.7	- M	- M	- M
FISH LAKE	3371	.0	1.6	0	49.2	96
GREEN LAKE	6000	.1	2.0	5	27.7	79
GROUSE CAMP	5380	.0	.5	0	31.6	108
MORSE LAKE	5400	19.4	33.6	58	77.0	104
SASSE RIDGE	4200	.0	23.8	0	42.9	87
TOUCHET #2	5530	.1	*	*	38.8	*
WHITE PASS E.S.	4500	.0	16.1	0	31.1	77
Basin wide percent of average				25		93
LEWIS, COWLITZ						
JUNE LAKE	3340	.1	.0	~	134.6	90
LONE PINE	3800	- M	20.5	- M	- M	- M
PARADISE	5120	23.5	49.3	48	- M	- M
PIGTAIL PEAK	5900	8.4	35.7	24	51.5	73
PLAINS OF ABRAHAM	4400	- M	38.7	- M	- M	- M
POTATO HILL	4500	.0	1.7	0	49.5	84
SHEEP CANYON	4030	.0	21.8	0	- M	- M
SPENCER MEADOW	3400	.1	1.6	6	78.0	85
SPIRIT LAKE	3120	.3	.0	~	- M	- M
STRAWBERRY LANDING	4800	2.4	21.0	11	77.2	85
SURPRISE LAKES	4250	.5	30.2	2	69.1	73
Basin wide percent of average				22		83
WHITE, GREEN, CEDAR, SKYKOMISH, SNOQUALMI, BAKER, SKAGIT						
CORRAL PASS	6000	12.8	26.1	49	47.7	84
COUGAR MOUNTAIN	3200	.0	1.6	0	76.1	84
OLALLIE MEADOWS	3700	- M	42.6	- M	- M	- M
STAMPEDE PASS	3860	.0	32.2	0	38.0	46
Basin wide percent of average				21		71
STATE WIDE percent of average				27		85

Provisional data, subject to revision.

* = Average not available. ~ = Percent not computed. M = Missing reading.
Water Content and Precipitation readings are reported in inches.
Average period covers 1961-1985.

The Drought Severity (Long-Term, Palmer) Index

Lyle M. Denny and Thomas R. Heddinghaus

The Drought Severity, or Palmer, Index is an index of meteorological drought (or moisture excess) and indicates prolonged abnormal conditions affecting water-sensitive economics. The index usually ranges from about -6 to $+6$, with negative values denoting dry spells and positive values, wet spells of weather (categories of values are given under the accompanying map). The equations for the index were derived from monthly average data and based on the concept of a balance between moisture supply and demand (Palmer, 1965). The equations have been modified to compute the index on a weekly basis for publication in the Bulletin. Input data consists of weekly temperature averages and precipitation totals for 350 climate divisions in the United States and Puerto Rico.

The index is a sum of the current moisture anomaly and a portion of the previous index to include the effect of the duration of the drought or wet spell. The moisture anomaly is the product of a climate weighting factor and the moisture departure. The weighting factor allows the index to have a reasonably comparable significance for different locations and time of year. An index value for a division in Florida would have the same local implication as a similar value in a more arid division in western Kansas. The moisture departure is the difference of water supply and demand. Supply is precipitation and stored soil moisture, and demand is the potential evapotranspiration, the amount needed to recharge the soil, and runoff needed to keep the rivers, lakes, and reservoirs at a normal level. The runoff and soil recharge and loss are computed by keeping a hydrologic accounting of moisture storage in two soil layers. The surface layer can store one inch, while the available capacity in the underlying layer depends on the soil characteristics of the division being measured. Potential evapotranspiration is derived from Thornthwaite's method (1948).

The index is measured from the start of a wet or dry spell and is sometimes ambiguous until a weather spell is established. A week of normal or better rainfall is welcome in an area that has experienced a long drought, but may be only a brief respite and not the end of the drought. Once the weather spell is established (by computing a 100 percent "probability" that an opposite spell has ended), the final value is assigned. To make the program have a real-time significance, a value is assigned based on a greater than 50 percent "probability" that the opposite weather spell has ended. This is not entirely satisfactory, but it does allow the index to have a value when there is a doubt that it should be positive or negative.

One aspect that should be noted is that the demand part of the computations includes three parameters—potential evapotranspiration, recharge of soil moisture, and runoff—any one of which may produce negative values. If only enough rain fell to satisfy the expected evapotranspiration but not enough to supply the recharge and runoff, then a negative index would result. If such an odd situation continued, agriculture would progress at a normal pace but a worsening drought would be indicated. Shallow wells and springs would dry and the levels of rivers, lakes, and reservoirs would fall. Serious economic stress to the livestock trade, industries, and cities would eventually result. Then if rainfall fell below the minimum needed for agriculture, crops would suffer drastic and rapid decline because there would be no reserve water in the soil. Such a situation, to some extent, occurred during the Northeast drought in the mid-1960's when New York City almost ran out of water.

A detailed explanation and examination of the index is given by Alley (1984). Both Alley and Karl (1983) address the sensitivity of the index and list some limitations.

References:

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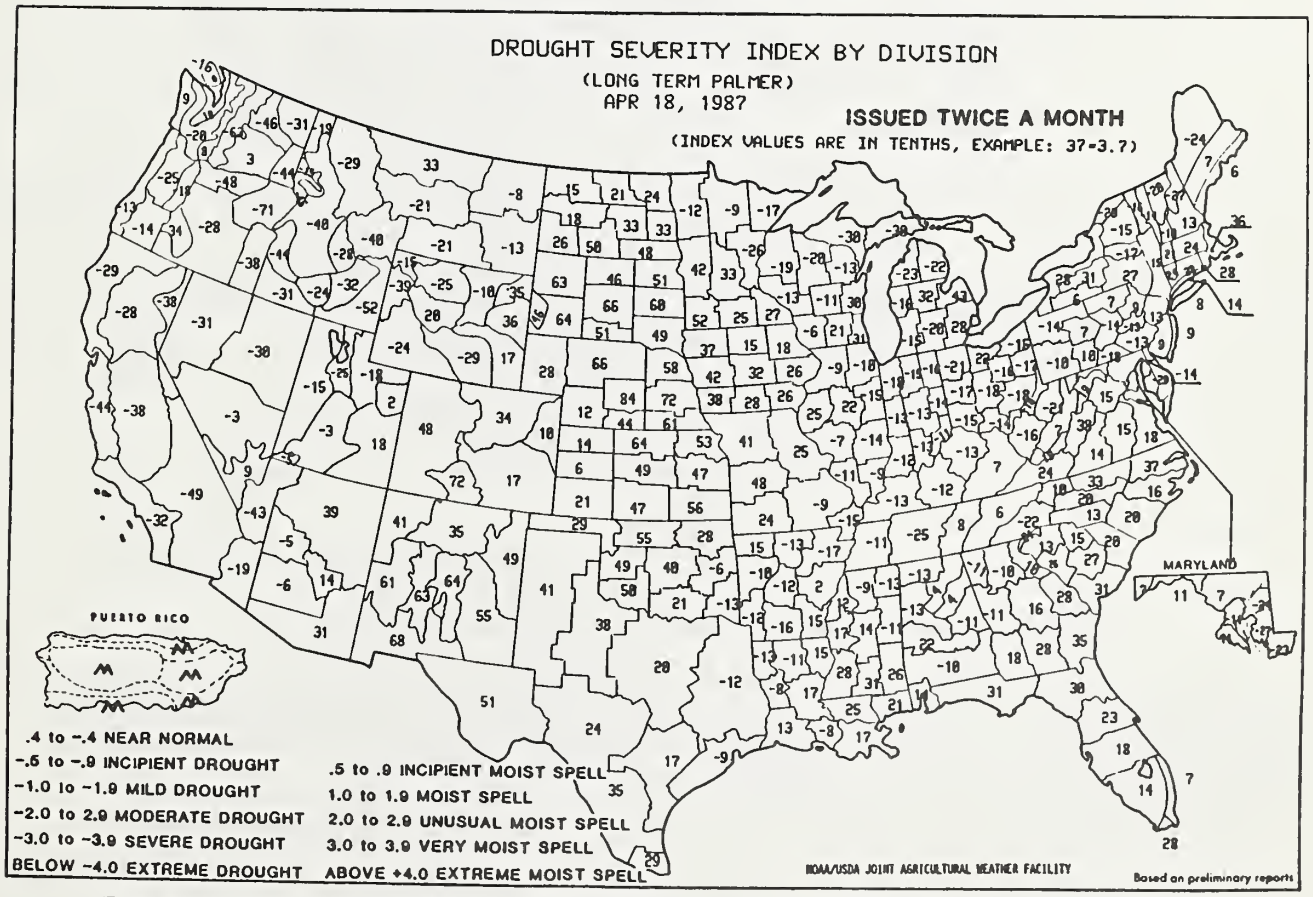
Palmer, W.C., 1965: *Meteorological Drought*, Weather Bureau Research Paper No. 45, U.S. Dept. of Commerce, Washington, DC, 58pp.

Thornthwaite, C.W., 1948: "An Approach Toward a Rational Classification of Climate," *Geographical Review*, 38, 55–94.



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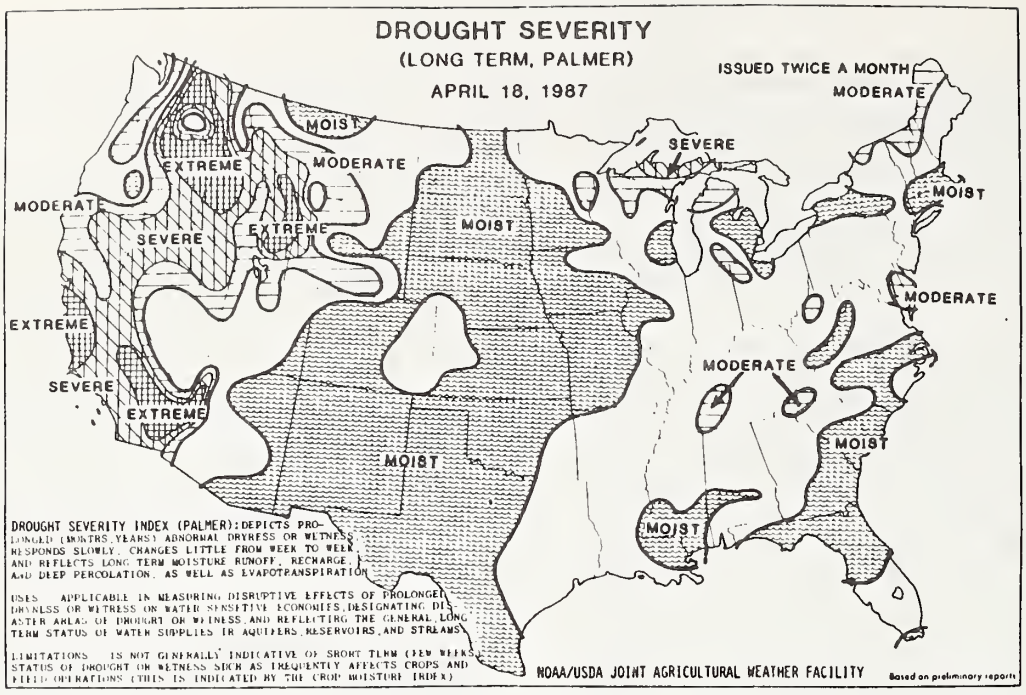

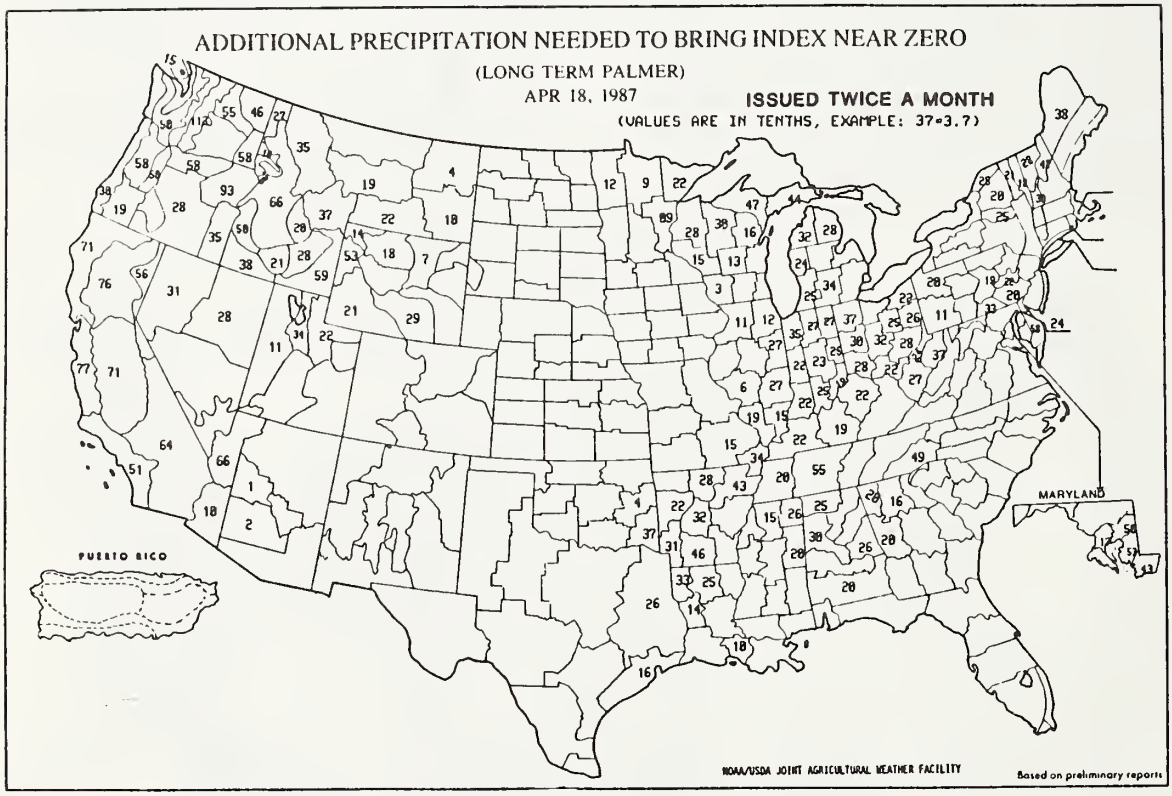

Additional Precipitation Needed to Bring the Drought Index to Near Zero

A parameter derived from the calculations of the Drought Severity Index is the additional precipitation in inches needed to bring the index to near zero. This parameter is computed for all values of the current week's index less than −.5 (the upper limit of an incipient drought) and left blank for all values greater than or equal to −.5. The precipitation values are theoretically the additional amounts required to end the drought defined by the index in each climatic division. In using this parameter to make projections, it must be realized that these values are instantaneous, valid only for the current week. To end the drought in a given climatic division for the oncoming week, the precipitation amount listed plus near-normal rainfall must occur.

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The Following Organizations Cooperate With The Soil Conservation Service In Snow Survey Work

Canada:

Ministry of the Environment, Water
Investigations Branch, Victoria, British Columbia

States:

Washington State Department of Ecology
Washington State Department of Natural Resources

Federal:

Department of the Army
  Corps of Engineers
U.S. Department of Agriculture
  Forest Service
U.S. Department of Commerce
  NOAA, National Weather Service
U.S. Department of the Interior
  Bonneville Power Administration
  Bureau of Reclamation
  Geological Survey
  National Park Service
  Bureau of Indian Affairs

Local:

City of Tacoma
City of Seattle
Chelan County P.U.D.
Pacific Power and Light Company
Puget Sound Power and Light Company
Washington Water Power Company
Snohomish County P.U.D.
Colville Confederated Tribes

Private:

Okanogan Irrigation District
Wenatchee Heights Irrigation District
Newman Lake Homeowners Association

Other organizations and individuals furnish valuable information for snow survey reports. Their cooperation is gratefully acknowledged.

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